Desalination Technology Roadmap and Research Facility Development

Sponsors:

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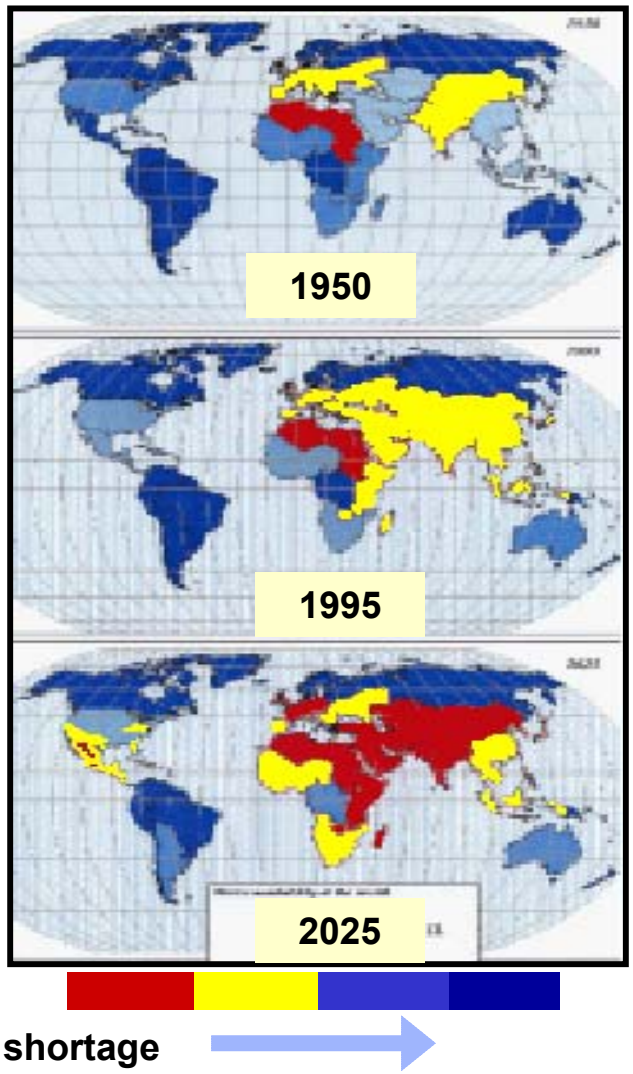
Over half the world's population will face severe water shortage in the next 50 years.

- In 1990, poor water supply and sanitation was the 2nd leading cause of death and disability worldwide.
- Over 50% of world's major rivers are dry or heavily polluted.
- By 2025, 20% more fresh water will be needed for irrigation and 40% more for cities to maintain current per capita water levels.
- **NONTRADITIONAL** water resources will need to be used to address these shortages.

"Water promises to be to the 21st century what oil was to the 20th century: the precious commodity that determines the wealth of nations."

Fortune Magazine, May 15, 2000



Roadmap Development - Vision

By 2020, water purification and desalination technologies will contribute significantly to assuring a safe, sustainable, affordable, and adequate water supply for the Unites States.

Safe:

- **Meet drinking water standards**
- **Agriculture and industry standards**
- **Security**

Sustainable:

- **Water table decline can lead to salinity increase**

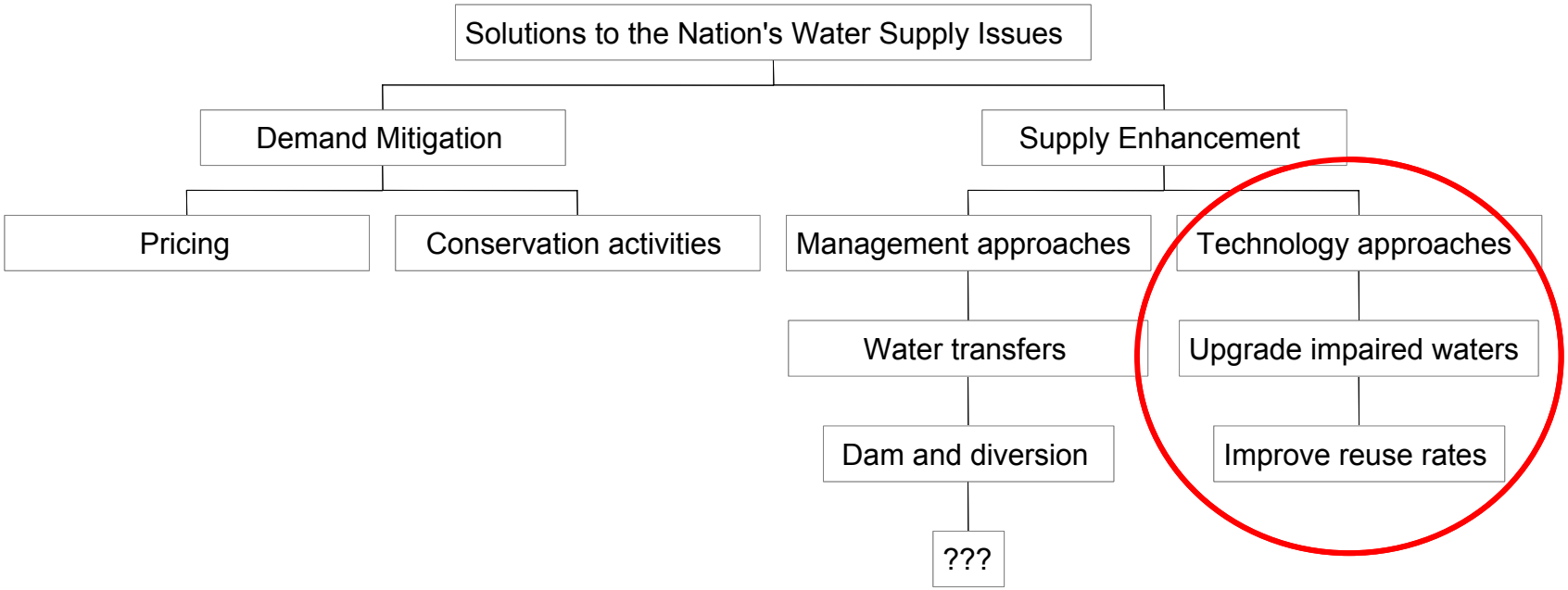
Affordable:

- **Future water cost comparable today's**

Adequate:

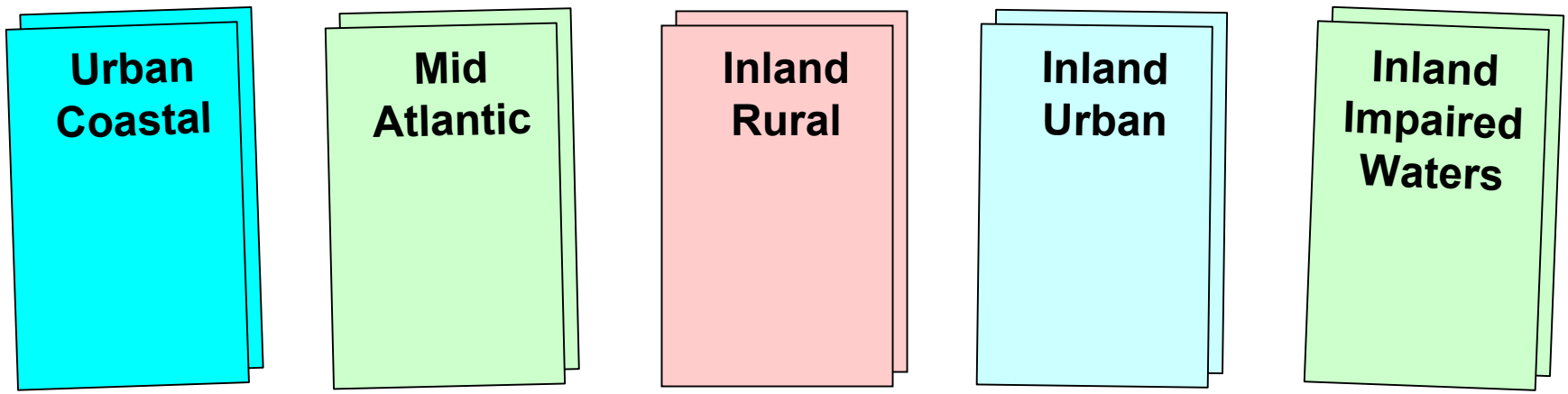
- **Local and regional availability**
- **Episodic shortages (droughts).**

Hierarchy of the nation's water solution toolbox



Structure of the Roadmap Process

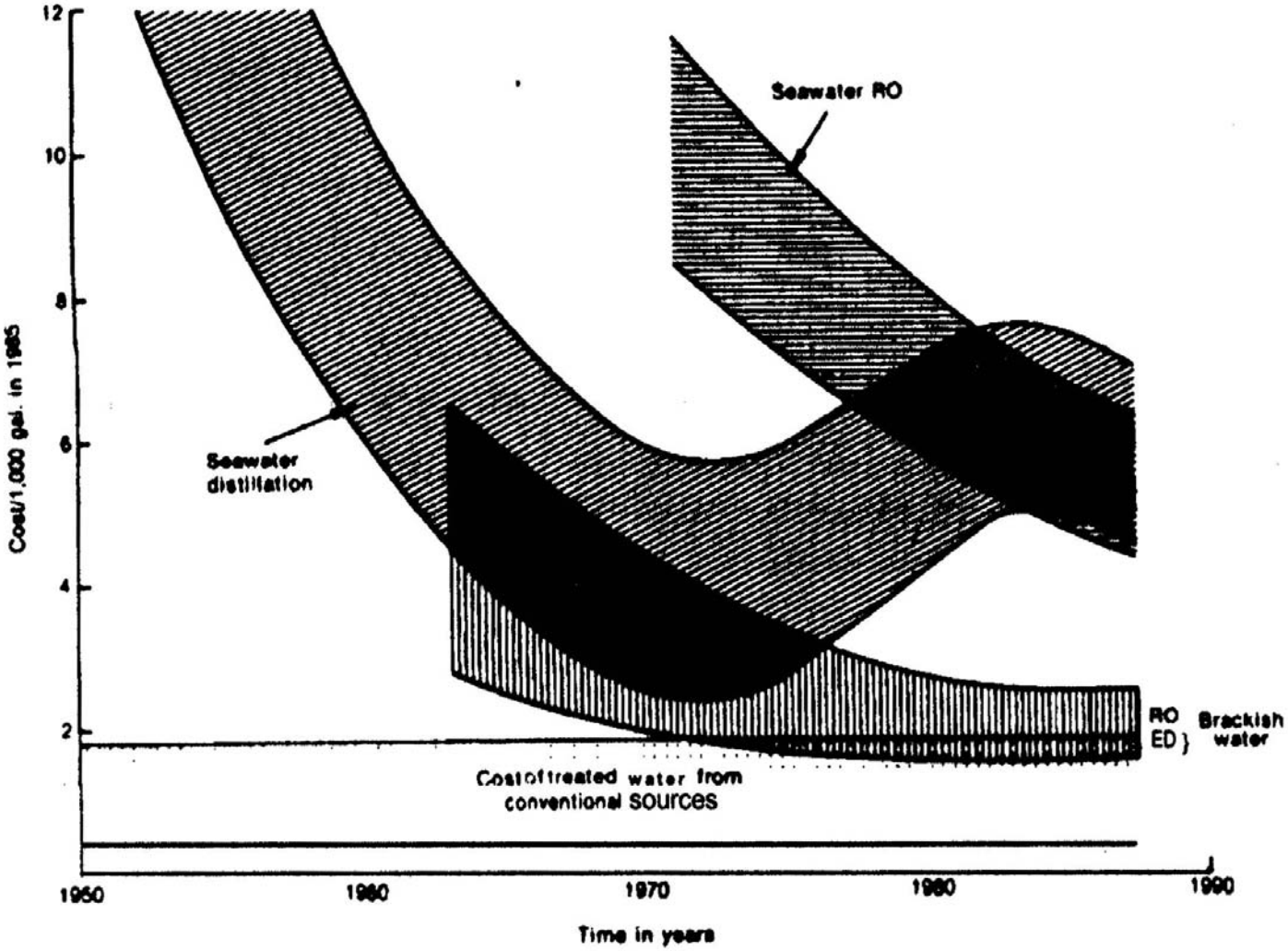
Case Studies a Basis for Needs



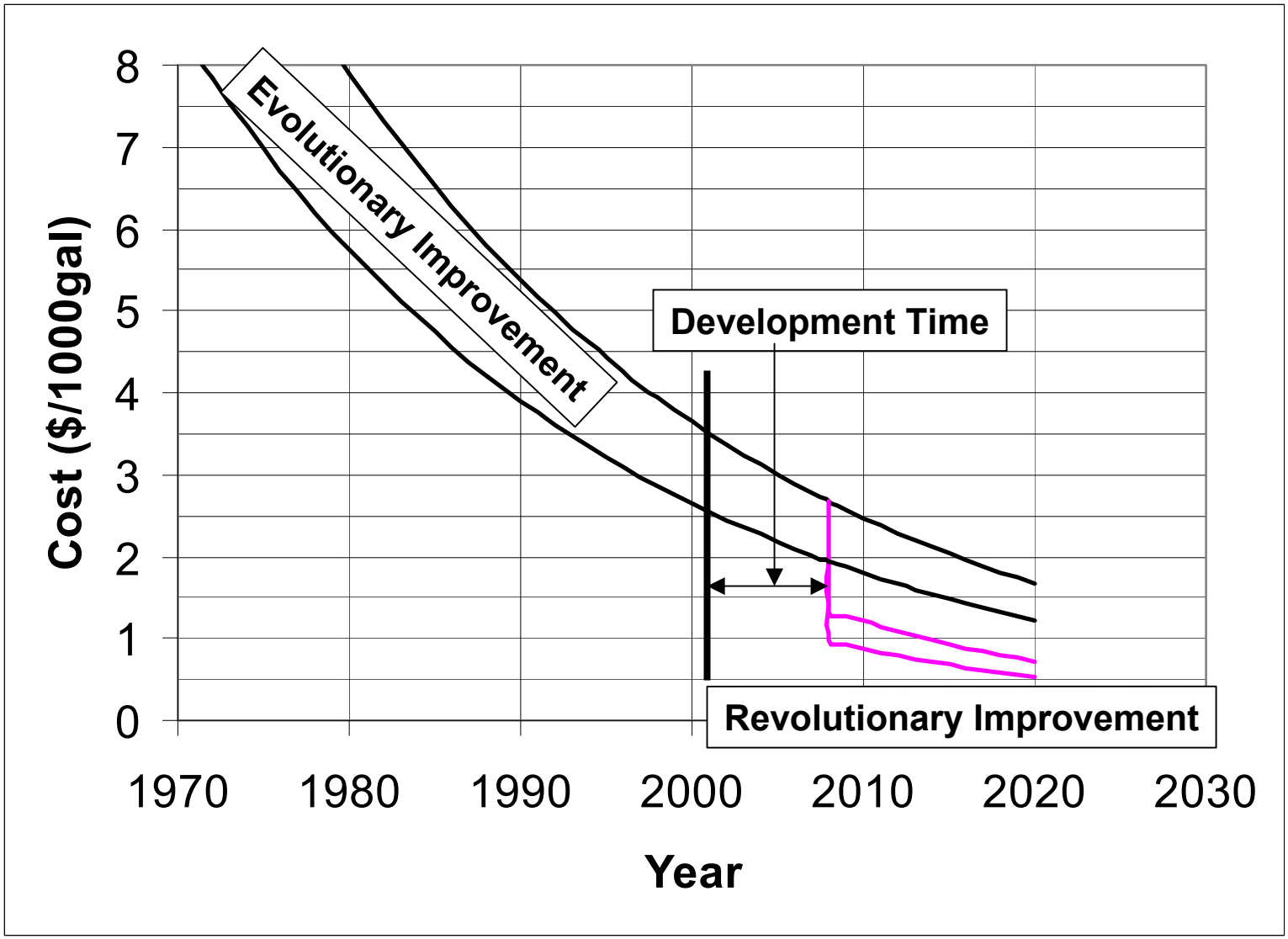
- **Develop new sources**
- **Reduce costs**
- **Protect quality**
- **Reclaim waters**
- **Develop concentrate disposal**

Historical Desalination Costs

Figure 9.—Approximate Desalination Costs

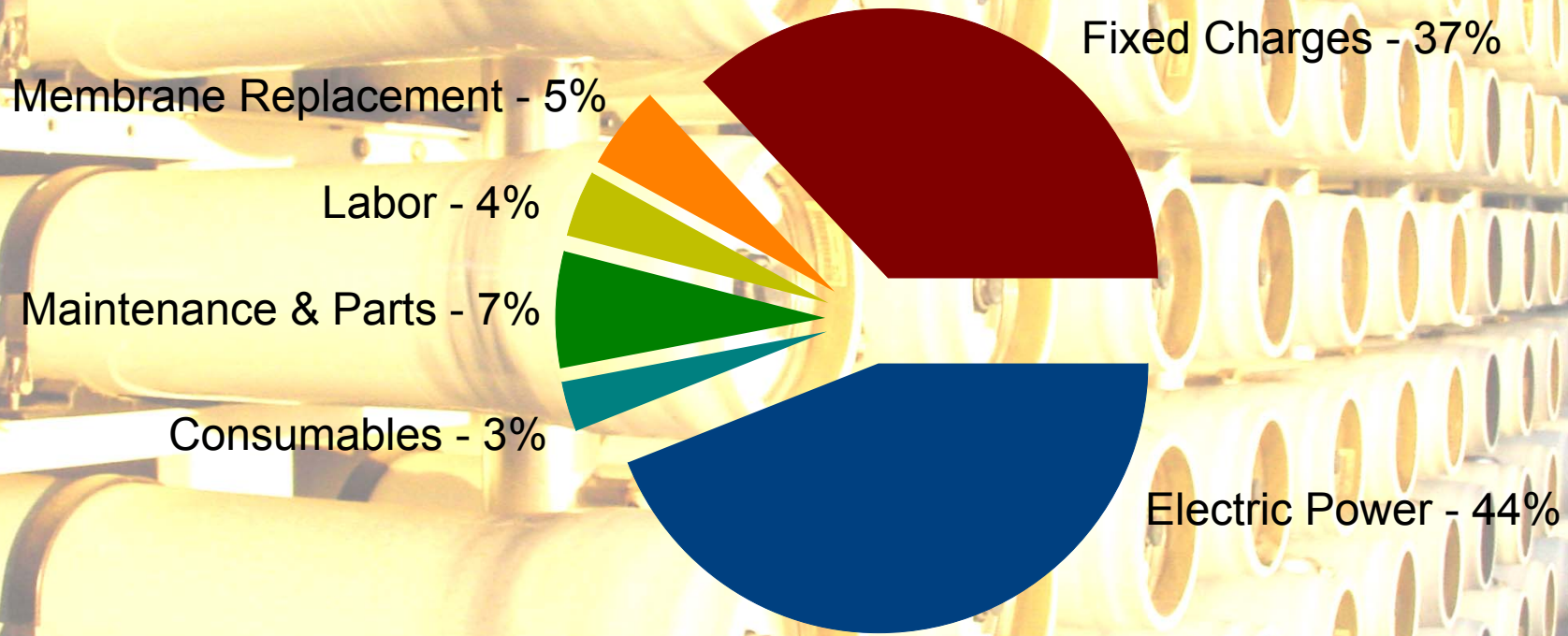


Effect of Evolutionary and Revolutionary Technologies



Evolutionary Approach
Seawater RO – Opportunity for Energy and Pretreat Savings

R. Semiat, Water International, Vol. 25, 54, (2000).



Pretreatment can be up to 30% of Total Operating Costs

K.S. Speigler and Y.M. El-Sayed, A Desalination Primer, Balaban Desalination Publications, Santa Maria Imbaro, Italy (1994).

NEEDS → Objectives (Reduce Costs)

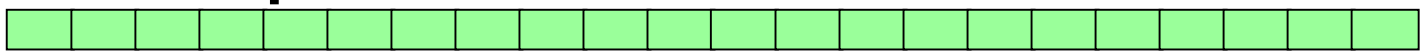
Technology Areas	Evolutionary Targets	Research Areas
Membranes		Basic Research to increase membrane permeability
Thermal	Reduce overall cost of seawater desalination from $2.50/1000 gal to $2.00/1000 gal by 2008	Clathrate sequestration
Alternative		Renewable energy
Concentrate Disposal	Recover 5% of concentrate for beneficial use by 2008	Sodium hypochlorite generation using concentrate
Recycling/Reuse	Reduce cost to produce reclaimed water by 25% by 2008.	Membrane Bioreactor

Technology Areas	Revolutionary Targets	Research Areas
Membranes		Develop Smart Membranes
Thermal	Reduce overall cost of seawater desalination from $2.50/1000 gal to $1.00/1000 gal by 2008	Forward Osmosis
Novel		Magnetic Separation
Concentrate Disposal	Reduce ZLD costs by 50%	Create super concentrate technology
Recycling/Reuse	Reduce cost to produce reclaimed water by 50% by 2008.	Develop power saving technology

Revolutionary Approach

Series of Screens

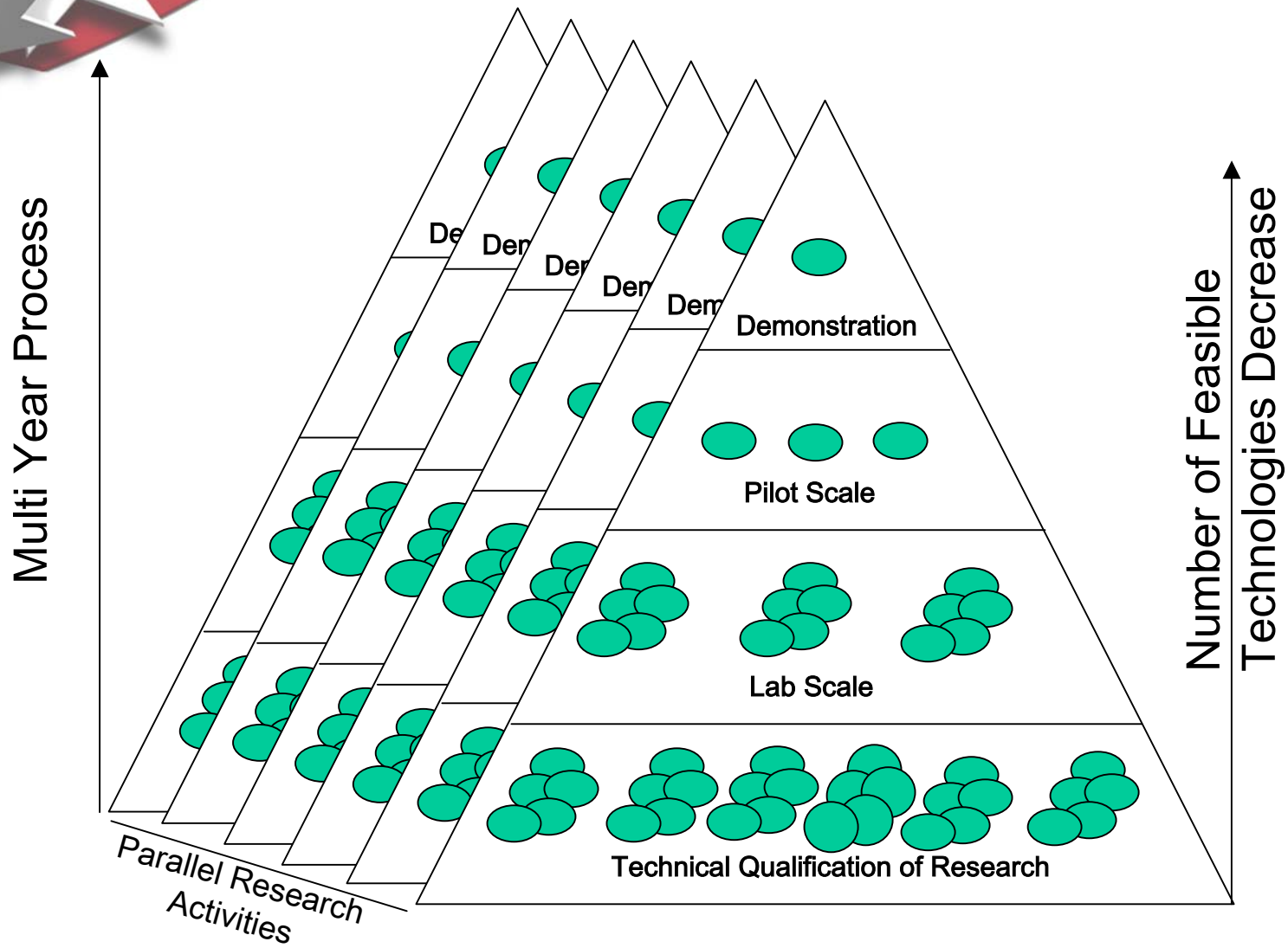
Technical qualification of research – M&E Balances



Lab Scale Evaluations

Pilot Scale Evaluations

Demonstrations

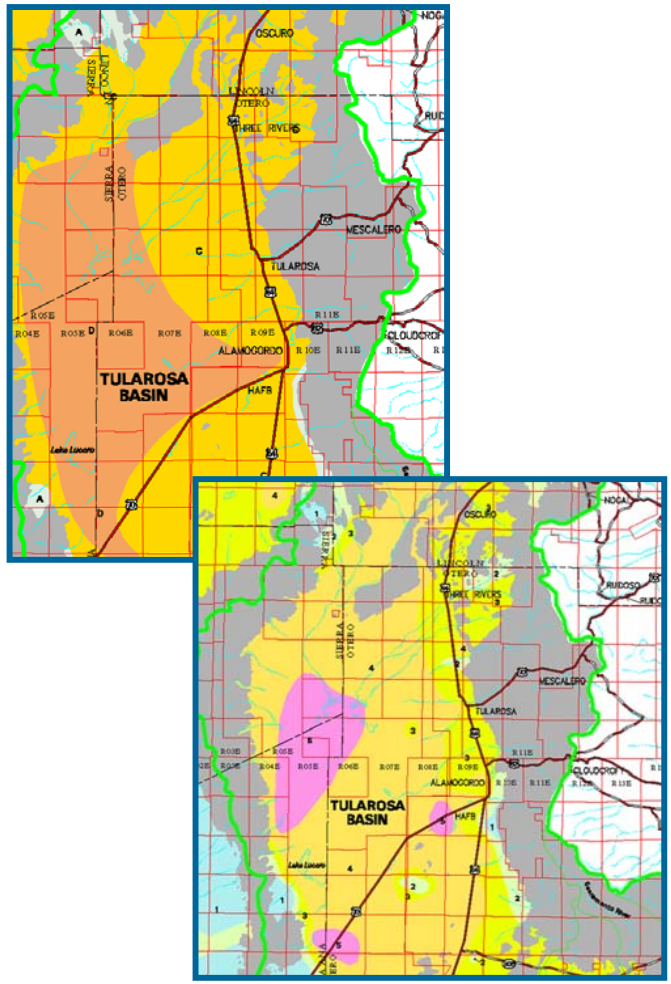


In order to have demonstration scale experiments for the National Desal Centers program, there must be a major program to develop worthy candidate revolutionary technologies. Without this program, only evolutionary research will be available for testing.

Tularosa Basin National Desalination Research Facility

Study Objectives

- **The BOR and Sandia received congressional funding in FY02 to:**
  - **Identify desalination research opportunities for a Tularosa Basin facility**
  - **Identify a regional, national, and international role that would complement other "national water research centers"**
- **Develop a preliminary facility design and operation and management plans**
- **Complete draft study by July 2002**
- **Develop facility design/build plan for FY03 start of construction**

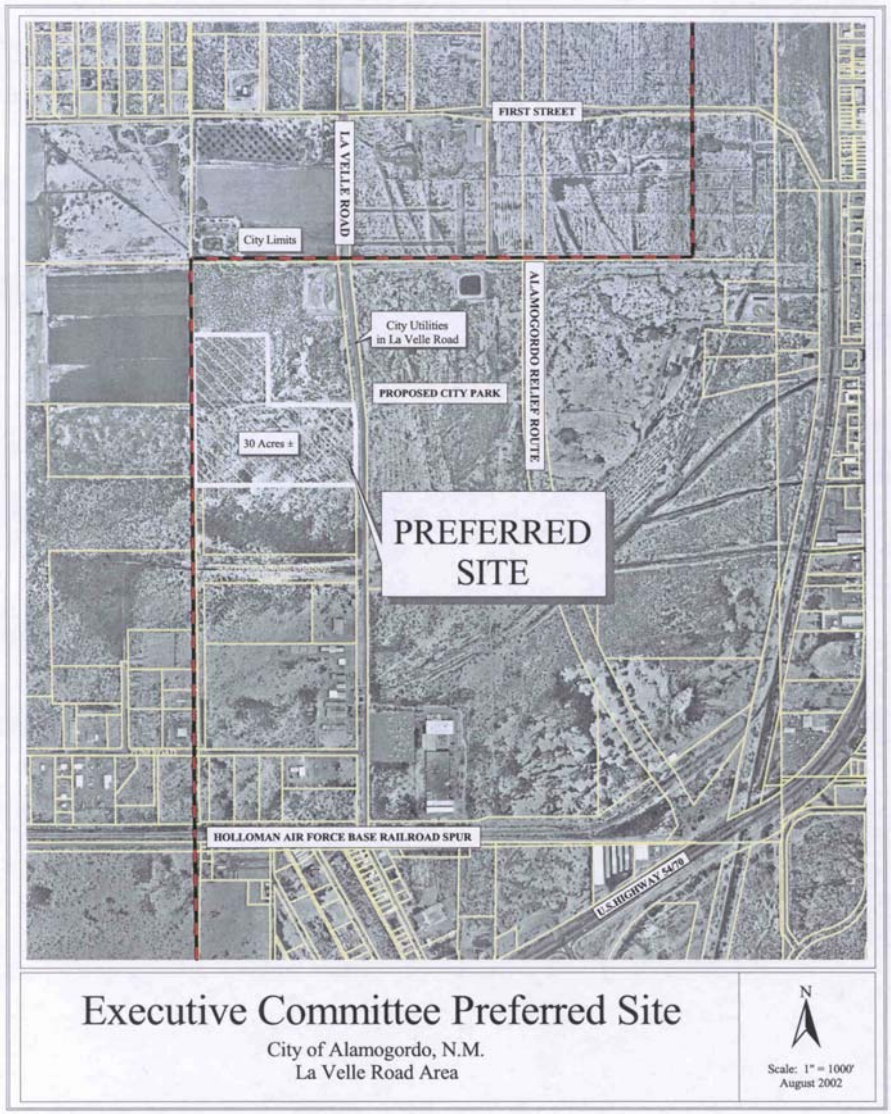


Tularosa Basin National Desalination Research Facility

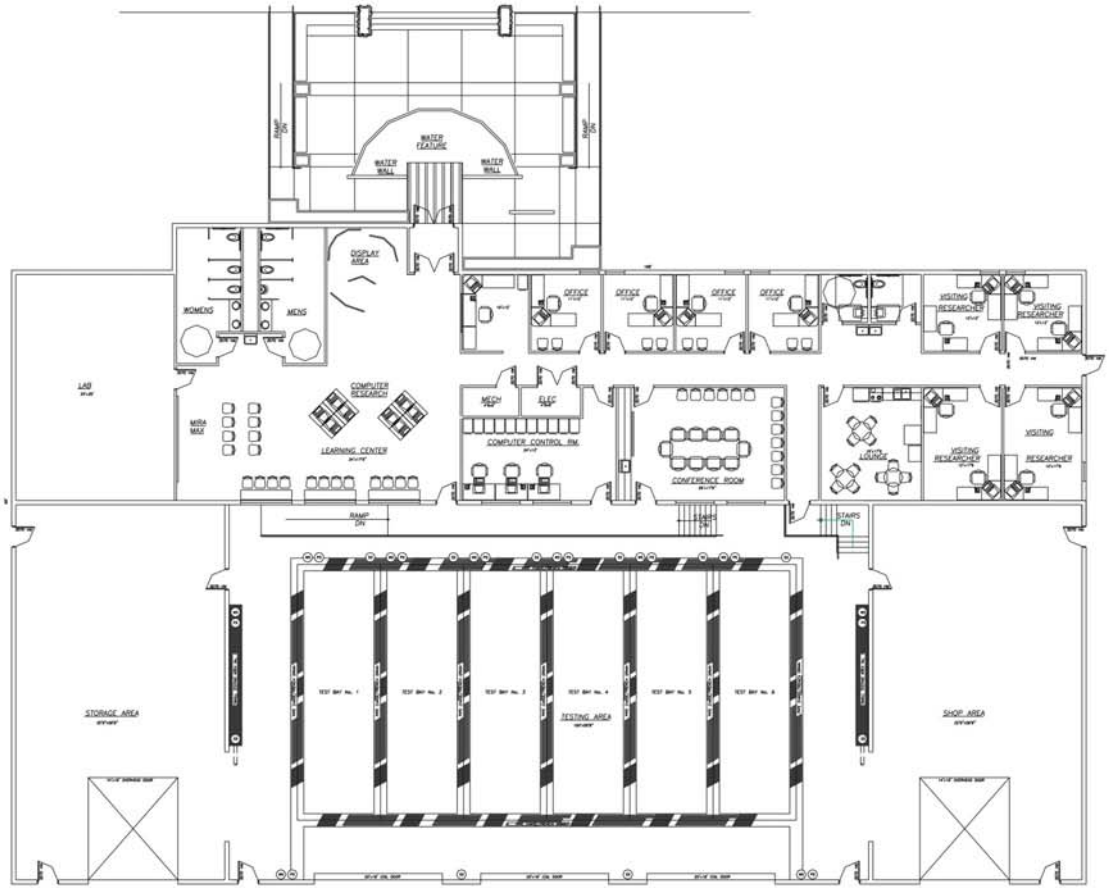
Design Highlights

- **3 primary site locations identified with easy access, good visibility, water availability**
- **20-30 acre sites with areas for concentrate reuse and beneficial use research, renewable energy desalination research, and ~13,000 square foot desalination research facility**
- **Desalination facility: 6 test bays for pilot system testing at 30 gpm, control room, water lab, research offices, resource/education room, conference room, operations viewing and tour areas, passive solar building**
- **Shop and chemical storage areas and exterior pads for large scale and renewable energy applications**

Tularosa Basin National Desalination Research Facility



Tularosa Basin National Desalination Research Facility



BUILDING FLOOR PLAN

1/8"= 1'-0"

0 8' 16' 24'

SCALE: 1/8" = 1'-0"

A	CONCEPTUAL SUBMITTAL	4/02	EBC				
ISSUE	DESCRIPTION	DATE	DRWN	CHKD	ENGR	MNGR	

NIMS, CALVANI & ASSOCIATES, P.A.

LIVINGSTON ASSOCIATES, P.C.

PROJECT MANAGER

ARCHITECT | MECHANICAL

CIVIL | ELECTRICAL

STRUCTURAL | DRAWN BY

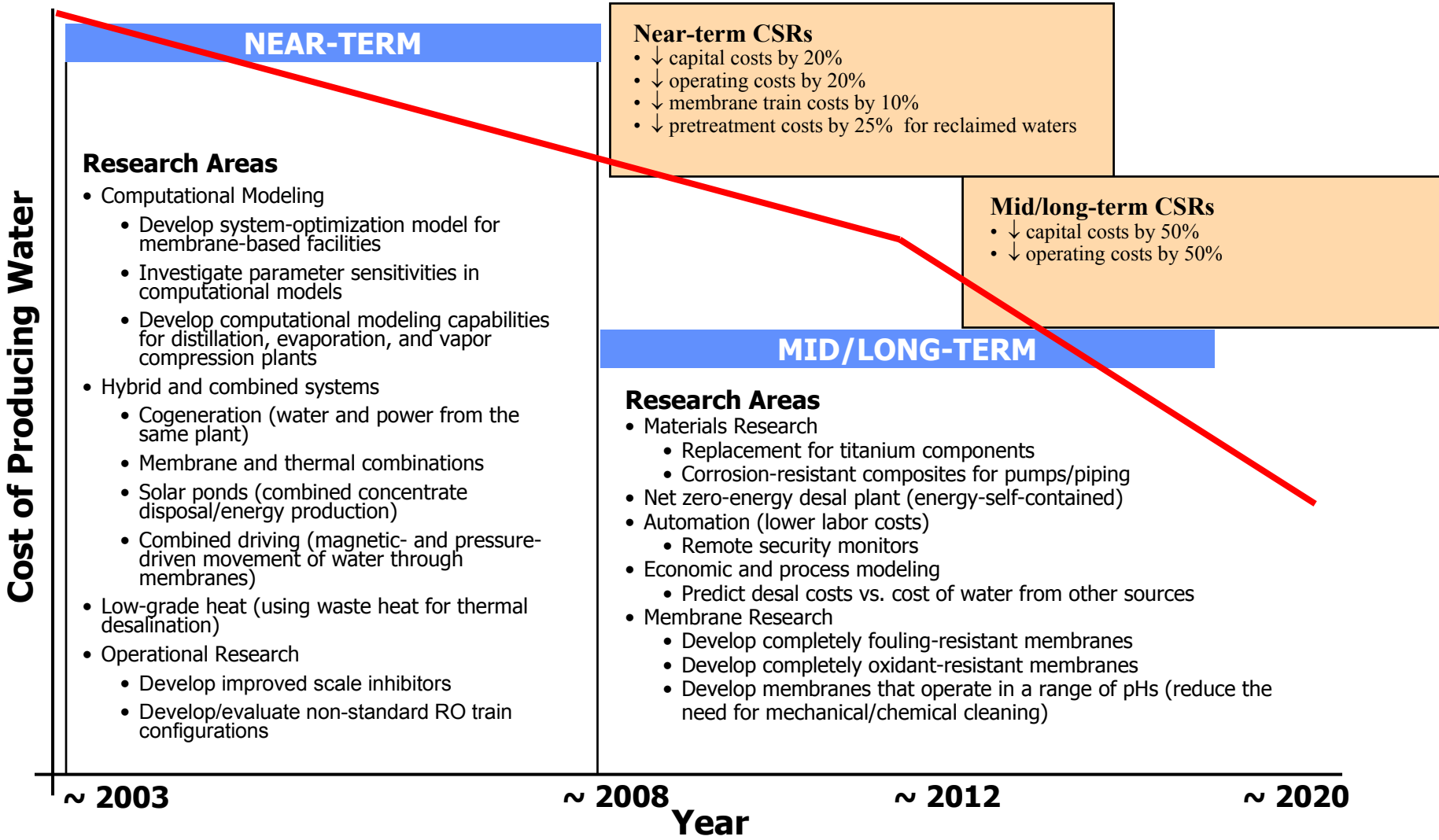
DESALINATION RESEARCH FACILITY

RECOMMENDED FLOOR PLAN
FIGURE 7

DATE | PROJECT NO. | SHEET NO. | ISSUE

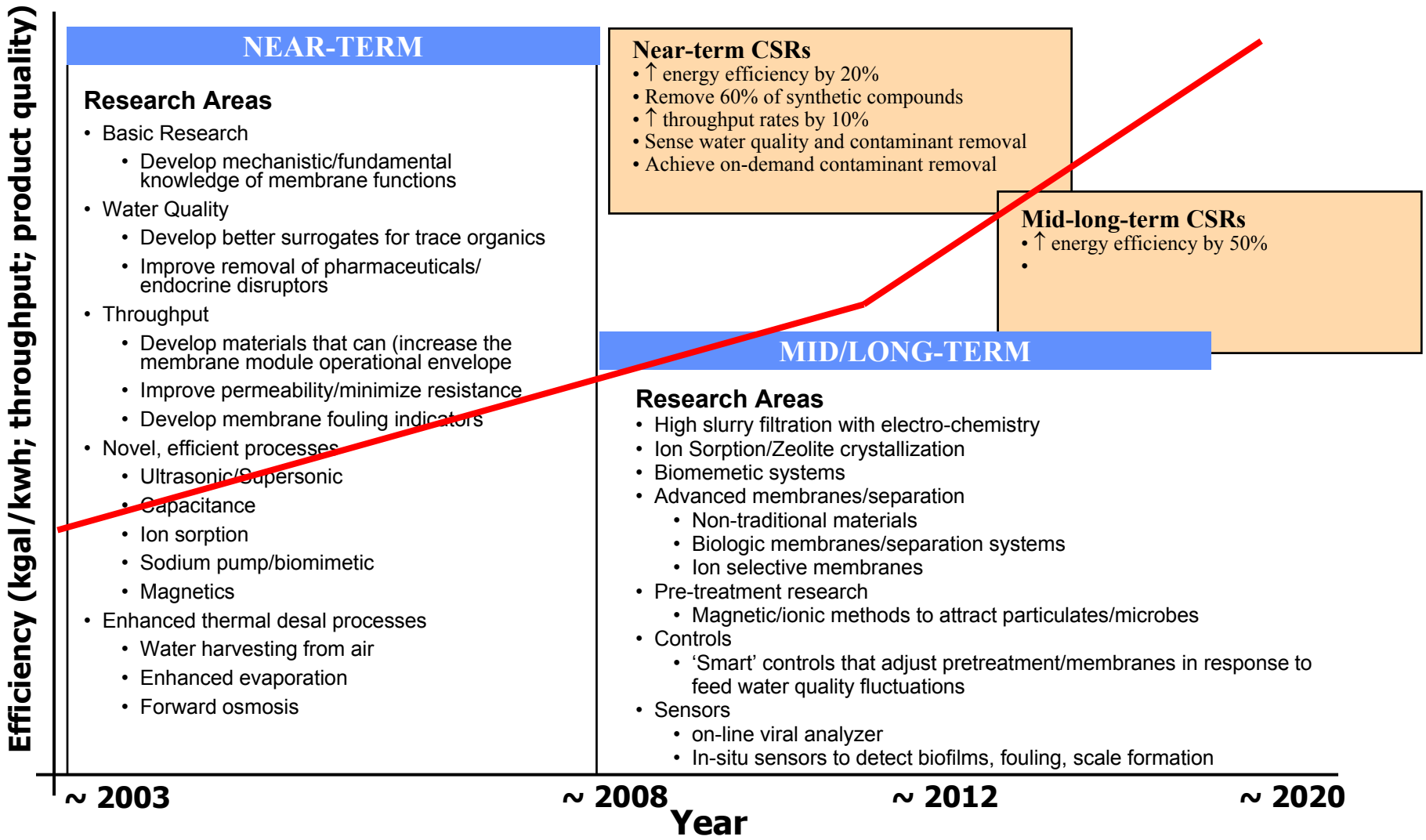
SCALE: 1/8" = 1'-0"

NEED: Reduce Production Cost of Water

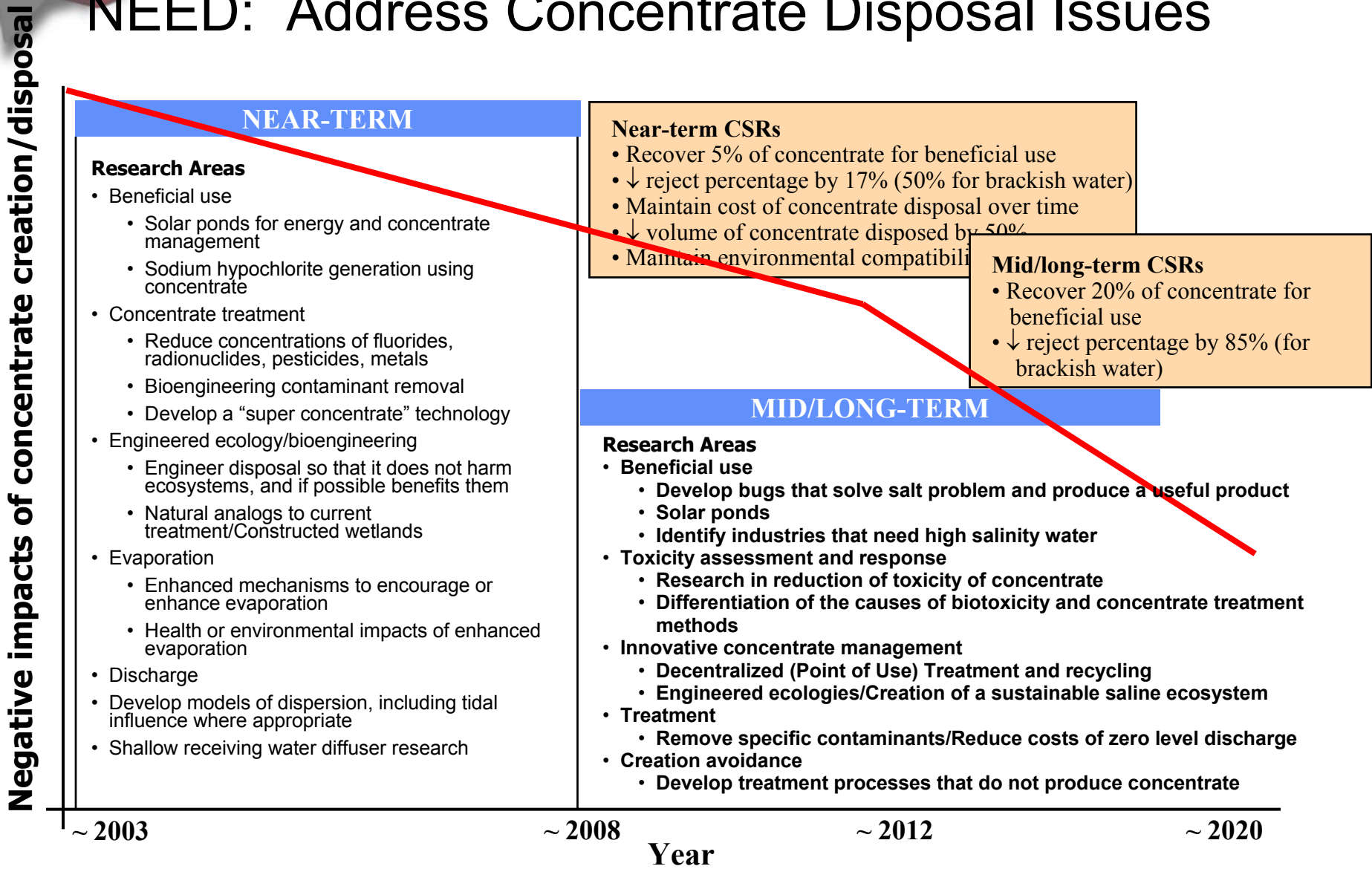


NEED: Increase Production Efficiency

(throughput, component lifetime, quality)



NEED: Address Concentrate Disposal Issues



NEED: Increase Reclamation and Reuse of Water